International Union for Conservation of Nature Ecosystem Visualizer

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Introduction

We present an interdisciplinary research project as a visualizer that will help conservation scientists model and simulate ecosystems. It started as a request from the geography department of Clark University and is now being developed with close collaboration between computer science students and advisers in computer science and geography departments. To build a tool for scientists and field surveyers to facilitate the visualzing process of their sketchs of ecosystems, we utilize Java framwork JGraphX. It is capable of drawing and exporting biological system diagrams, whose specifications come from Internation Union for Conservation of Nature, to have a standardized way of modeling the system so that the publications and presentations share a common presentation approach.

Why Use a Visualizer?

Identification of key ecological processes is an essential element of the ecosystem description. Therefore, geologists and environmental scientists use diagrams in their reserach papers and presentations to represent their conceptual models they create from their research and field surveys. An example is the Fig. 1 below.
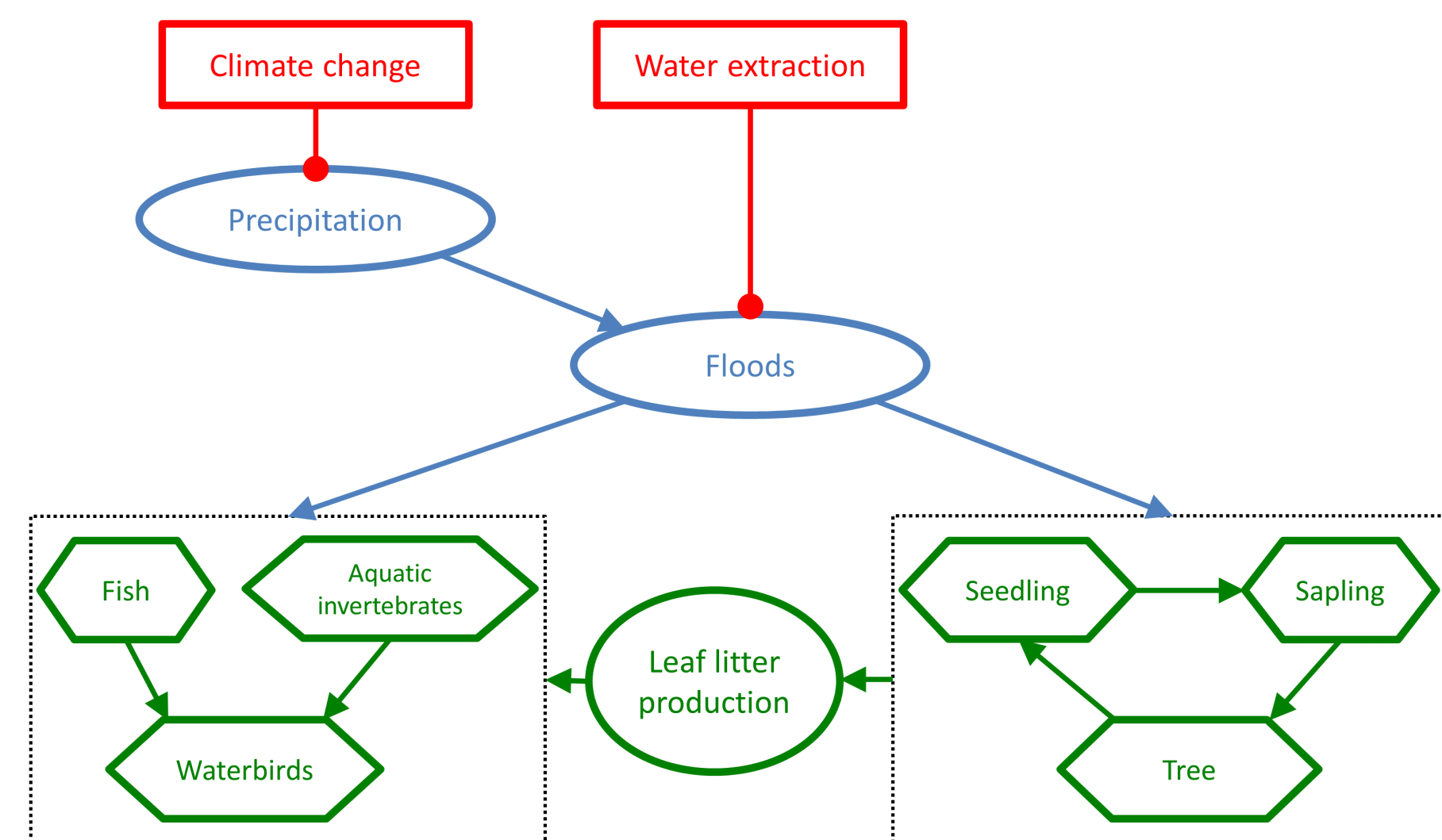

Figure 1: Cause-effect model of the Gonakier forest in Senegal [1]

The scientists look for a way to streamline and standardize the process, so that these conceptual diagrams look more uniform, are easier to create, modify, and exchanged. Furthermore, there is demand in simple analyzing power in the software, capable of determining the effect of some of the factors.

Choice of Framwork—JGraphX

Licensed under BSD license, the JGraphX framework is a Java framework that could be used to build a desktop applet enabled to create and process graphs, which could be easily saved and opened, visualized, analyzed, and interacted with.

It has the possibility to be customized. The shapes and relationship we need for IUCN guidelines could be coded into the framework, and lightweighted database and analysis functionalities are possible to be integrated.

As a familiar language for both of the developers, Java is the language of choice when it comes to faster adaptation, and less learning overhead.

Lastly, one of the requirements for the app is to be cross-platform. This choice of language and framework suits this purpose.
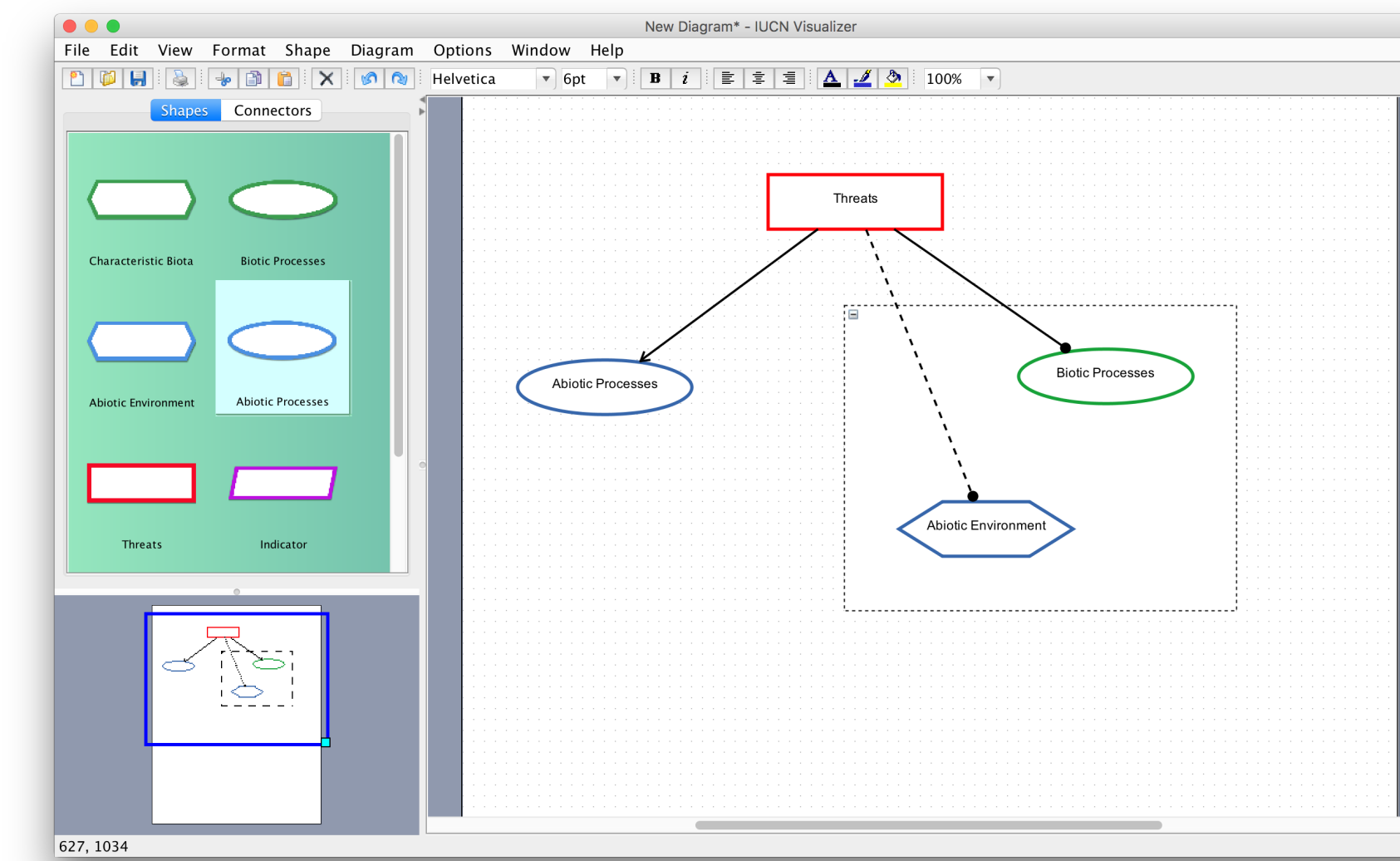
Important Result

This program could now produce conceptual model diagrams that conform to the IUCN recommendations. Different shapes, arrowheads, and compartment are all implemented.

Implementation

To customize our editor `GraphEditor`, we have to modify a sample program provided by JGraphX, and extend that class `BasicGraphEditor`.

We also implemented our own version of `DecoratedConnectorShape` which extends `mxConnectorShape`, and `ParallelogramShape` which extends `mxBasicShape`.

Other different shapes are modified based on the basic shapes provided, using XML. One of the difficulties is to correctly define the perimeters of the shapes, to perfectly attach the arrows to the shapes.

The UI buttons of these shapes are drawn in vector drawing program and attached to the program. However, we have yet to figure out proper way to do anti-aliasing.

Screen Shot

Here we attach a screen shot of the program running on Mac OS X.

Figure 2: Screen Shot of the Program

Development Status

Currently, the project is hosted on a private GitHub repository. Basic funtionalities are in place, but we look forward to further perfection of the documentation, and improvment and implementation on a few requested functionalities, most notably the database and the analysis ability. The program prototype has been distributed to end-users, and constructive feedbacks have been collected since. They could direct the path of future work.
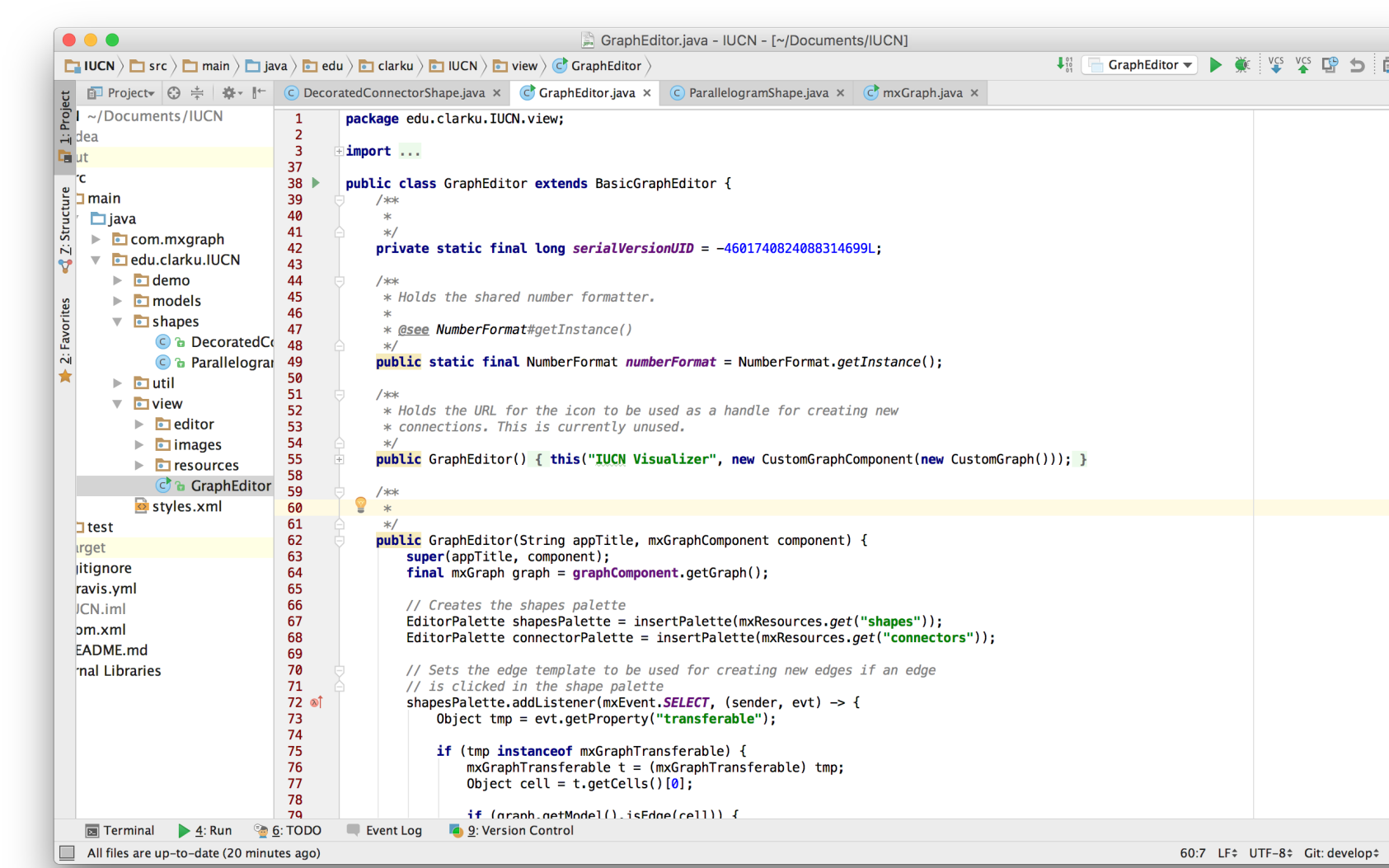

Figure 3: Screen Shot of the Development Progress

Conclusion

The project successfully addresses a real word demand for a convenient visualizing tool for biosystem conceptual models. This tool is offline, cross-platform, and portable. The program enables easy drawing, saving, and exchange of such diagrams, and convenient export to most format people work with, including vector format which is suitable for publishing.

The project has also left great room for improvement. At current stage the software is capable of drawing diagrams via drag and drop from predefined gadgets list. Future planned functions include simple analyzing ability, which qualitatively indicates the effect the change of the factors will have on the biosystem. A prototype version has been shared with IUCN scientists and the first round of feedback is being incorporated into ongoing development.
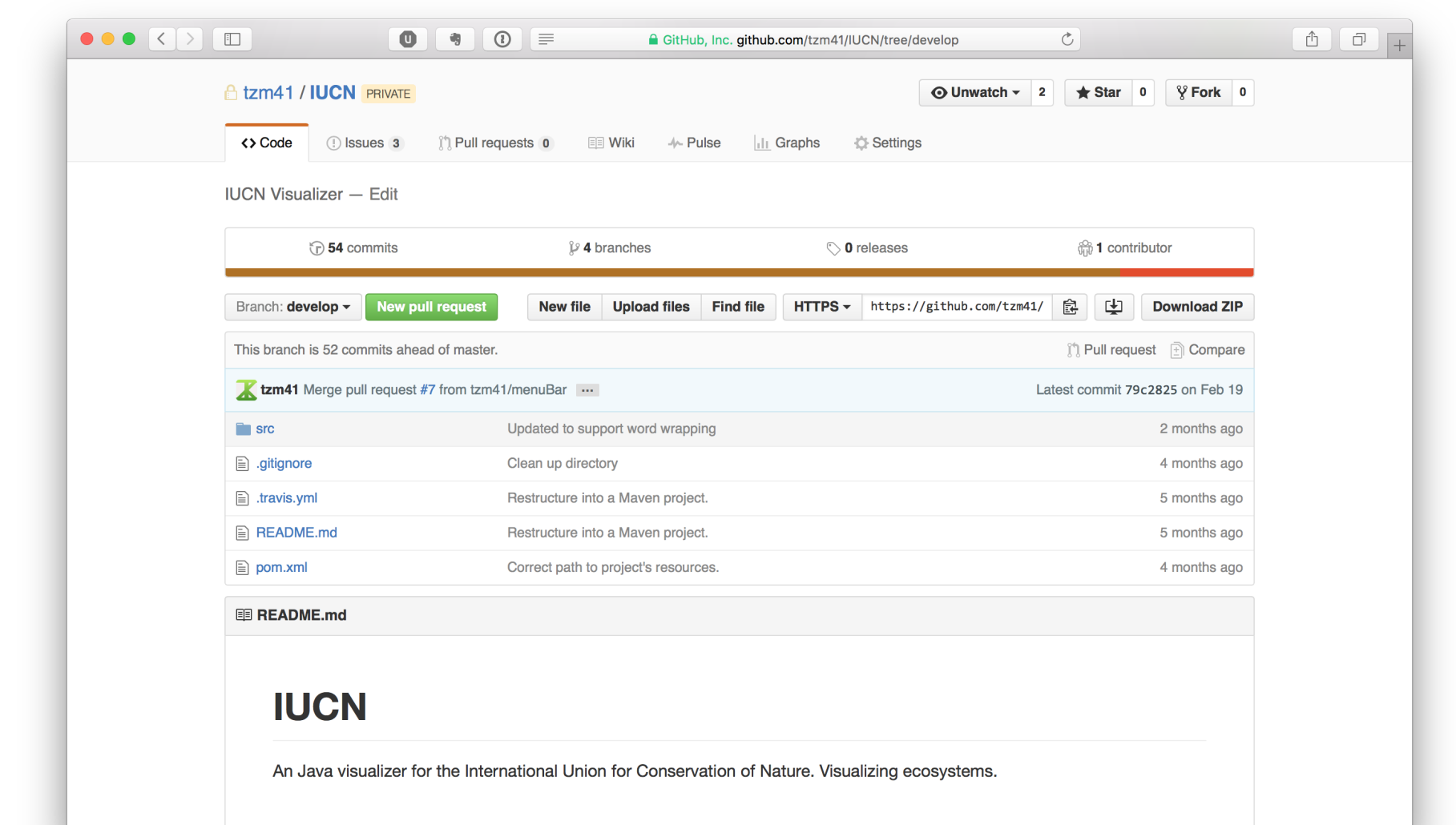

Figure 4: Project page on GitHub

References

[1] David A Keith, Jon Paul Rodríguez, Kathryn M Rodríguez-Clark, Emily Nicholson, Kaisu Aapala, Alfonso Alonso, Marianne Asmussen, Steven Bachman, Alberto Basset, Edmund G Barrow, et al. Scientific foundations for an IUCN Red List of Ecosystems. *PLOS one*, 8(5):e62111, 2013.

Acknowledgements